

Electronic Life-detection Instrument for Enceladus/Europa (ELIE)

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<u>Target:</u> Enceladus/Europa plume sampling, lander, sub-surface explorer; Mars; prebiotic environments (Titan, other Ocean Worlds)

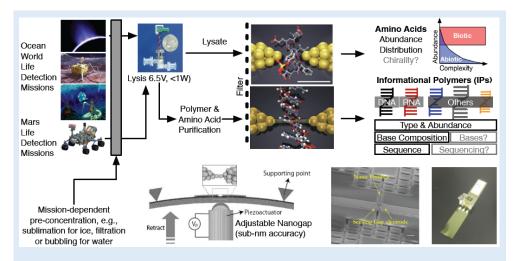
Science:

- Single molecule detection and discrimination of amino acids, distribution of amino acids relative to biotic or abiotic expectations.
- Single molecule detection of RNA, DNA, and other linear charged informational polymers (IPs) including non-standard bases/polymers
- Sequencing of nucleic acids for detection of forward contamination or ancestral relationship

Objectives:

- Validate single molecule discrimination of pure biomolecules (amino acids, nucleic acids)
- Extend discrimination to biomolecular mixtures using protocell and microbial models of increasing fidelity (Ocean World analogs)
- Develop breadboard system and advancement plan to achieve TRL-6 by PDR of Enceladus Plume fly through, Europa Lander, or other relevant Ocean Worlds mission.

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ELIE will leverage extraction capabilities developed as part of the MatISSE-funded Search for Extra-Terrestrial Genomes (SETG) instrument, and targets a more diverse range of biomolecules using single molecule quantum electron tunneling (QET) nanogap sensors, previously validated to distinguish between different amino acids and to detect RNA and DNA, with nascent sequencing capabilities.

Key Milestones:

- Amino acid detection, discrimination, and distribution measurement at single molecule level (year 1)
- Informational polymer (IP) type, base composition, and limited sequencing of RNA, DNA (year 1)
- Discriminate between biomolecule types in mixtures and initial testing using model samples (year 2)
- Develop and validate breadboard with target of 10 ppt sensitivity (year 3)

TRL 2 to 4